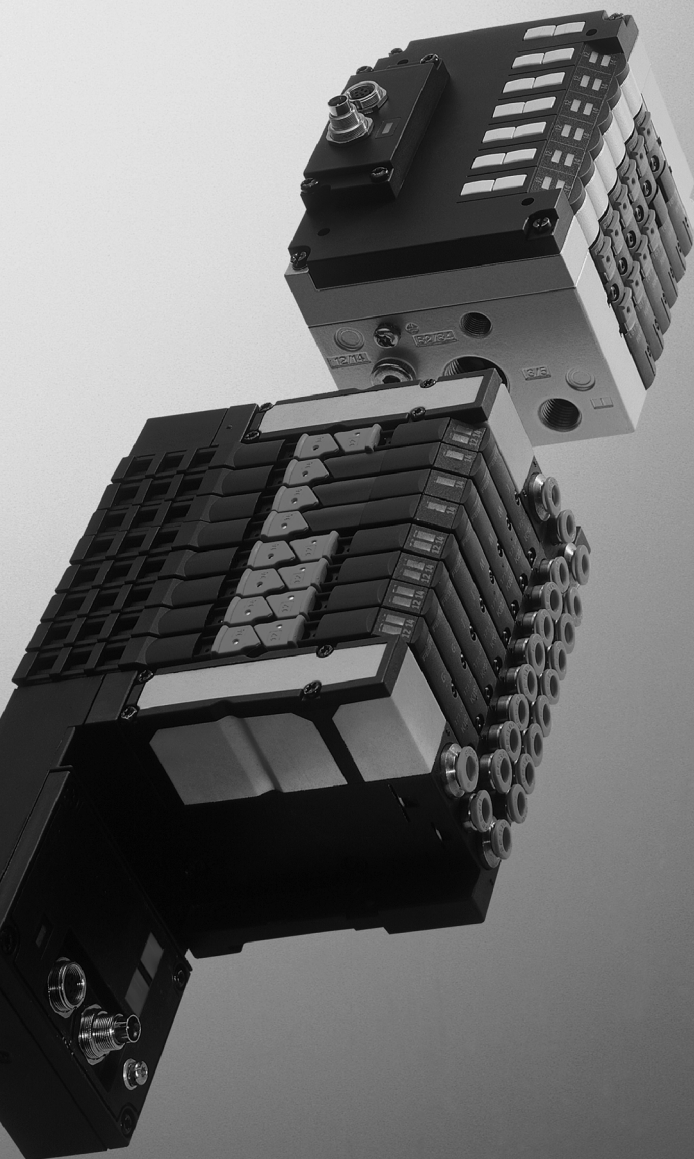


# Compact performance



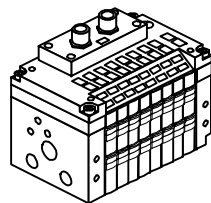
## FESTO

### Manual Electronics

CPV valve terminal  
with direct connection

Type CPV..-GE-DN-8

Field bus protocol:  
- DeviceNet



**Manual**  
175 563  
en 0009a



## Contents and general instructions

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## Intended use

The CPV valve terminal type CPV-... with direct connection type CPV...-GE-DN-8 described in this documentation has been designed exclusively for use as a slave on the DeviceNet. The valve terminal may only be used as follows:

- as intended
- in original condition
- without any modifications
- in faultless technical condition.

The maximum specified values for pressures, temperatures, electrical data, torques, etc. must be observed.

Please comply with national and local safety laws and regulations.

If you wish to implement an emergency stop function, please note the measures described in chapter 1.3.4.



### Warning

If the valve terminal is used as an explosion-protected operating medium, do **not** disconnect the connections under tension.

## Target group

This manual is directed exclusively at personnel trained in control and automation technology, who have experience in installing, commissioning, programming and diagnosing slaves on the DeviceNet.

## **Service**

If you have any technical problems, please contact your local Festo Service.

## **Notes on the use of this manual**

This manual contains specific information on installing, commissioning, programming und diagnosing CPV valve terminals with direct connection for DeviceNet.

Information on fitting and on the pneumatic components of the CPV valve terminal can be found in the Pneumatics manual P.BE-CPV-... .

## Important user instructions

### Danger categories

This manual contains instructions on the dangers which may occur if the product is not used correctly. These instructions are marked with a heading (Warning, Caution, etc.), printed on a shaded background and accompanied by a pictogram. A distinction is made between the following danger categories:



#### **Warning**

This means that there is a danger of serious injury to human beings and damage to property if these instructions are not observed.



#### **Caution**

This means that there is a danger of human injury and damage to property if these instructions are not observed.



#### **Please note**

This means that there is a danger of damage to property if these instructions are not observed.

In addition, the following pictogram marks passages in the text which describe activities involving electrostatically sensitive components:



Electrostatically sensitive components: Incorrect handling may result in damage to the components.

## Marking special information

The following pictograms mark passages in the text containing special information.

### Pictograms



Information:

Recommendations, tips and references to other sources of information.



Accessories:

Information on necessary or useful accessories for the Festo product.



Environment:

Information on the environment-friendly use of Festo products.

### Text markings

- The bullet denotes activities which can be carried out in any sequence.
- 1. Figures denote activities which must be carried out in the order specified.
- Hyphens denote general activities.

# Installation

## Chapter 1

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## 1. Installation

### 1.1 General instructions on installation



#### **Warning**

Switch off the following before undertaking installation and/or maintenance work:

- the compressed air supply
- the power supply for the bus interface/internal logic
- the load voltage supply to the valves.

You can thereby avoid:

- sudden uncontrolled movements of loose tubing
- unexpected movements of the connected actuators
- non-defined switching states of the electronic components.



#### **Caution**

The CPV valve terminal contains electrostatically sensitive components.

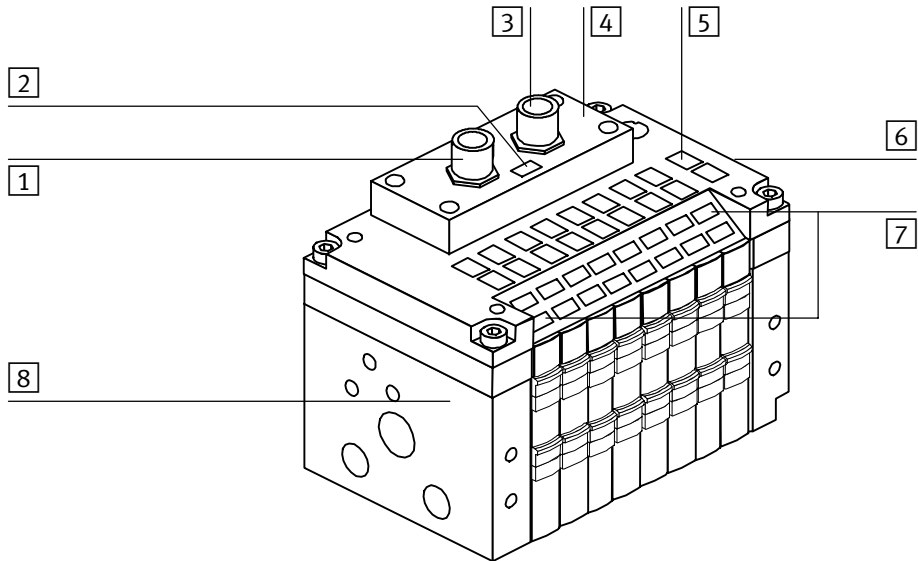
- Do not therefore touch any contacts.
- Please observe the regulations for handling electrostatically sensitive components.

In this way, you will avoid damaging the electronic components.

## 1. Installation

### Electrical connecting and display elements

The following connecting and display elements can be found on the CPV valve terminal with direct connection for DeviceNet:



- |   |   |
|---|---|
| <b>1</b> Load voltage connection for the CPV valves | <b>5</b> Identification labels                      |
| <b>2</b> Module/network status LED                  | <b>6</b> Earth connection (on right-hand end plate) |
| <b>3</b> Field bus connection                       | <b>7</b> Signal status display of pilot solenoids   |
| <b>4</b> Switch cover on the sub-base               | <b>8</b> Type plate                                 |

Fig. 1/1: Connecting and display elements

## 1. Installation

### 1.2 Setting the node address and the field bus baud rate

The following switches are situated under the switch cover on the sub-base of the CPV valve terminal:

- DIL-switch for setting the field bus baud rate
- Address selector switch for selecting the node address

Open and close the cover as follows:

- Opening Unscrew and remove the 4 screws in the switch cover. Lift up the cover.
- Closing Replace the cover. Tighten the 4 screws in diagonally opposite sequence.

- 1** Address selector switch (node address)
- 2** DIL-switch for the baud rate

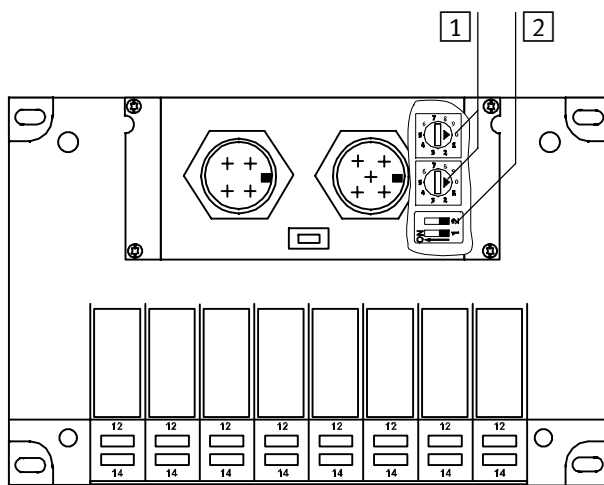


Fig. 1/2: Setting elements

## 1. Installation

### Setting the node address

You can set the node address of the CPV valve terminal with the two address selector switches. The switches are numbered from 0 to 9. The arrow on the address selector switches shows the tens or units figure of the set node address.

- 1 Address selector switch for the UNITS figure
- 2 Address selector switch for the TENS figure

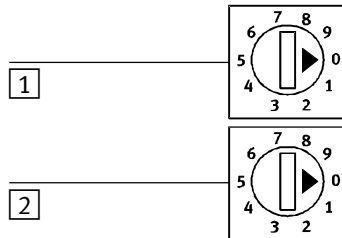


Fig. 1/3: Address selector switch



#### **Please note**

Node addresses may only be assigned once per module/scanner.



#### **Recommendation:**

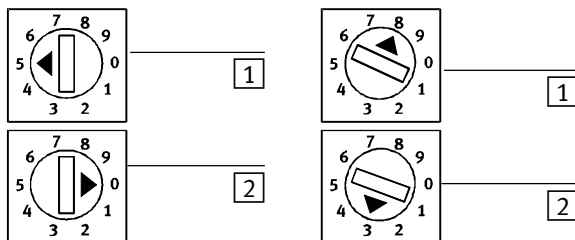
Assign the node addresses in ascending order. Assign the node addresses, if necessary, to suit the machine structure of your system.

## 1. Installation

The following node addresses are permitted: 0...63

Proceed as follows:

1. Switch off the power supply to the bus interface/internal logic as well as the load voltage supply for the CPV valves.
2. Assign an unused node address to the CPV valve terminal.
3. Use a screwdriver to set the arrow of the relevant address selector switch to the tens or units figure of the desired node address.



Setting with:  
field bus address: 05

1 UNITS

2 TENS

Setting with:  
field bus address: 38

1 UNITS

2 TENS

Fig. 1/4: Examples of address settings

1. Installation

Setting the field bus baud rate

Next to the address selector switches there is a DIL-switch with two switch elements. These are numbered from 1 to 2. The position “ON” is marked.



**Please note**  
Set the field bus baud rate of the CPV valve terminal so that it agrees with the setting of your module (scanner).

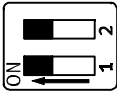
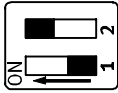
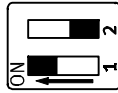
Field bus baud rate		
125 kBaud	250 kBaud	500 kBaud
		

Fig. 1/5: Setting the field bus baud rate

1.3 Connecting the CPV valve terminal

1.3.1 Connecting cable

Field bus cable

Use a twisted screened 4-core cable for the field bus. The bus interface and the internal logic of the CPV valve terminal are supplied with power via the field bus cable.



- Please note**
- Please refer to the PLC manual or the manual for your scanner for the correct type of cable. Take into account the distance and the baud rate selected.
  - Select the appropriate cable cross-sectional area.

Note the voltage drop:

- on the supply cable for the bus interface and
- the internal logic of the CPV valve terminal.

Bus length

The following table shows guide values for the maximum distance as a factor of the baud rate selected. Exact details can be found in the manuals for your controller or scanner.

Baud rate	Maximum trunk bus length	Length of branch lines	
		maximum	cumulative
125 kBaud	500 m	6 m	156 m
250 kBaud	250 m		78 m
500 kBaud	100 m		39 m

## 1. Installation

- |                    |  |
|--------------------|--|
| Load voltage cable | <ul style="list-style-type: none"><li>• Use a load voltage cable with sufficient cross-sectional area.</li><li>• Avoid long distances between the power unit and the CPV valve terminal.<br/>Long operating voltage cables reduce the voltage supplied by the power unit.</li><li>• If necessary, ascertain the most suitable cross-sectional area and the maximum permitted cable length.</li></ul> |
|--------------------|--|

### 1.3.2 Preparing the connecting cable

The connections for the field bus interface and the load voltage are in the form of plugs. The pin assignments of the field bus interface and of the load voltage connection are shown on the pages which follow.

- |                         |   |
|-------------------------|---|
| Load voltage connection | Use plugs from the Festo sales range for the load voltage connection. The plugs must match the outer diameter of the cables used (see Appendix A, Accessories). |
| Field bus plug          | Ready-to-use cables with plugs from various manufacturers are available for the field bus connection (see Appendix A, Accessories).                             |

## 1. Installation

- 1 Cables
- 2 Housing
- 3 Connecting part
- 4 Strain relief

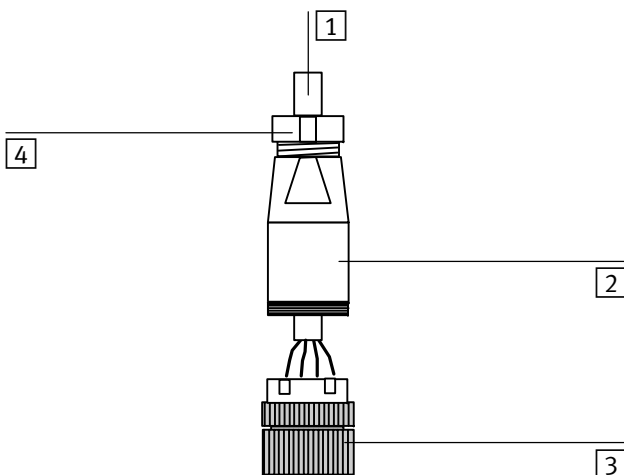


Fig. 1/6: Preparing the connecting cable

### Preparing the cables

When you have selected suitable cables, connect them as follows (Fig. 1/6):

1. Loosen the centre knurled nut in order to open the socket.
2. Open the strain relief on the rear of the housing. Then pass the cable through.
3. Remove 5 mm of the insulation and fit end sleeves onto the wires.
4. Connect the conductors.
5. Insert the connecting part into the housing of the plug again. Pull the cable back so that there are no loops inside the housing.
6. Tighten the strain relief.

1.3.3 Selecting the power unit



Use only power units which guarantee reliable isolation in accordance with IEC 742/EN 60742/ VDE 0551 with at least 4 kV isolation resistance (Protected Extra-Low Voltage, PELV). Switch power packs are permitted providing they guarantee reliable isolation in accordance with EN 60950/VDE 0805.

The current consumption of a CPV valve terminal depends on the number of valve coils. Recommendation:

- Use closed-circuit power units.
- When selecting a power unit, make sure that it has sufficient power output. To do this, calculate the total current requirements as shown in the following table:
- Connect the load voltage for the CPV valve coils via the EMERGENCY STOP circuit.

Total current consumption

The following table shows you how to calculate the total current consumption of a CP system. The values specified have been rounded up.

Current consumption Bus interface and logic		Sums
CP valve terminal		50 mA
Current consumption of the valve supply		
Current consumption of all simultaneously energized valve coils <sup>1)</sup>	__ x __ mA	= ____ mA
<sup>1)</sup> Current consumption depends on valve type (see Technical specifications of the valves)		

## 1. Installation

### 1.3.4 Connecting the load voltage for the CPV valves



#### Warning

If the valve terminal is supplied with load voltage via an output of a “fail-safe I/O module”, make-contact test pulses of the “fail-safe I/O module” can cause the valve terminal to react unexpectedly.

- Make sure that make-contact test pulses are reliably suppressed or switched off.



#### Caution

Protect the load voltage of the CPV valve coils with an external fuse max. 2 A.

With the external fuse you can avoid functional damage to the CPV valve terminal in the event of a short circuit.

Power is supplied via the 4-pin M12 plug on the CPV valve terminal.

- 1** Load voltage connection

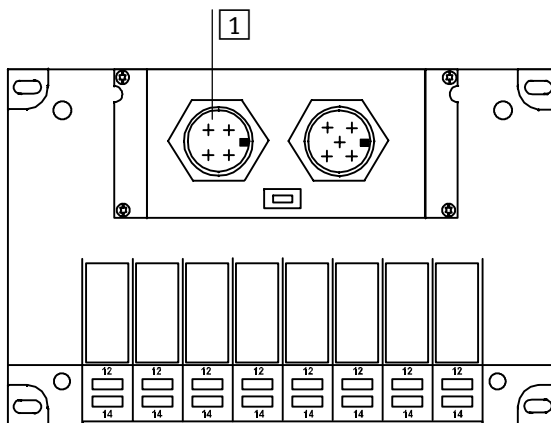


Fig. 1/7: 24 V DC load voltage supply

The current consumption depends on the type of valve coil. Please refer to the Pneumatics manual P.BE-CPV-... for the values.



Recommendation:

- Connect the load voltage for the CPV valves (pin 2) via the EMERGENCY STOP circuit.



### **Please note**

Check within the framework of your EMERGENCY STOP circuit to ascertain the measures which are required for putting your machine/system in a safe state in the event of an EMERGENCY STOP.

- Switching off the load voltage for the valves and output modules in the secondary circuit of the power unit.
- Switching off the compressed air supply to the valve terminal.

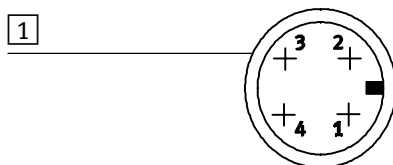
When the load voltage is switched off, there may be a delay before the valves are also switched off. This is due to energy being stored in the input circuitry of valve terminals.

Take this into consideration, e.g. as follows:

- By registering the switch-off moment of the load voltage by means of an input signal in the controller.
  - By blocking the control signal for the valves by locking the output signal with the “Load voltage” input signal.
- Check the 24 V load voltage while your system is operating. Make sure that the load voltage lies within the permitted tolerance even during operation at full load.

## 1. Installation

### Pin assignment of the load voltage connection of the CPV valve terminal



- 1** Pin assignment
- 1: n.c. (not connected)
  - 2: 24 V DC load voltage for the CP valves
  - 3: 0 V load voltage for the CP valves
  - 4: n.c. (not connected)

Fig. 1/8: Pin assignment of the load voltage connection (view of plugs on the valve terminal)

### Earthing

The CPV valve terminal has an earth connection on the end plate.



#### Please note

- Connect the earth connection of the end plate to the earth potential with low impedance (short cable with large cross-sectional area).

You thereby avoid faults caused by electromagnetic influences.



#### Remark:

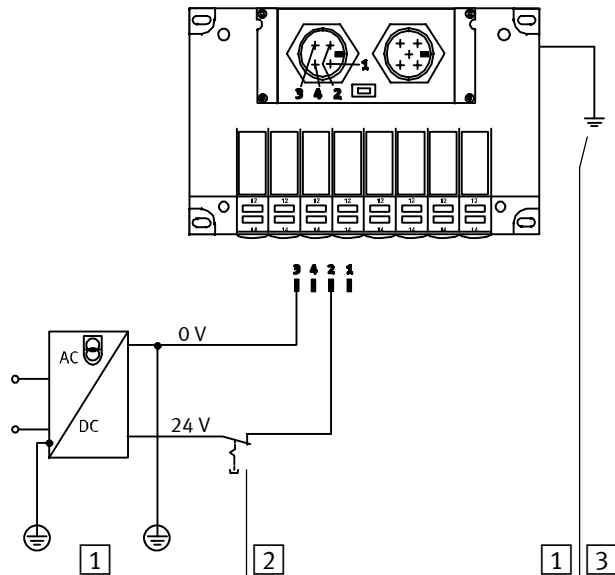
By using PELV power units with Festo valve terminals, you can ensure protection against electric shock (protection against direct and indirect contact) in accordance with EN 60204-1 / IEC 204. The SPC11 must be earthed in order to guarantee the operation of certain functions (e.g. EMC).

## 1. Installation

### Connection example

Please note the following when connecting the 24 V load voltage (pin 2):

- Observe the tolerance (DC 21.0 V...26.4 V)
- Connect the earth connection of the CPV valve terminal with a cable with a suitable cross-sectional area.



- 1 Potential equalization
- 2 The 24V load voltage supply for the valves can be switched off separately. The bus interface and the internal logic are supplied with power via the field bus connection.
- 3 Earth connection on the end plate.

Fig. 1/9: Connecting the load voltage

### 1.4 Connecting to the field bus

There is a bus plug on the CPV valve terminal for connecting it to the DeviceNet. The following is/are connected to this plug:

- the two bus cables
- the power supply (+ 24 V DC and 0 V) for the bus interface and internal logic
- the cable screening.

The hardware basis of the bus interface is the CAN bus. It is typical for this bus that the bus interface is supplied with power via the field bus plug.

Field bus socket

The bus is connected via a branch line with a 5-pin M12 socket with PG9 screw connector. You can order these from Festo. (type FBSD-GD-9-5POL, part no. 18324).



Alternately, you can use ready-to-use bus cables from various manufacturers (see also Appendix A, Accessories).

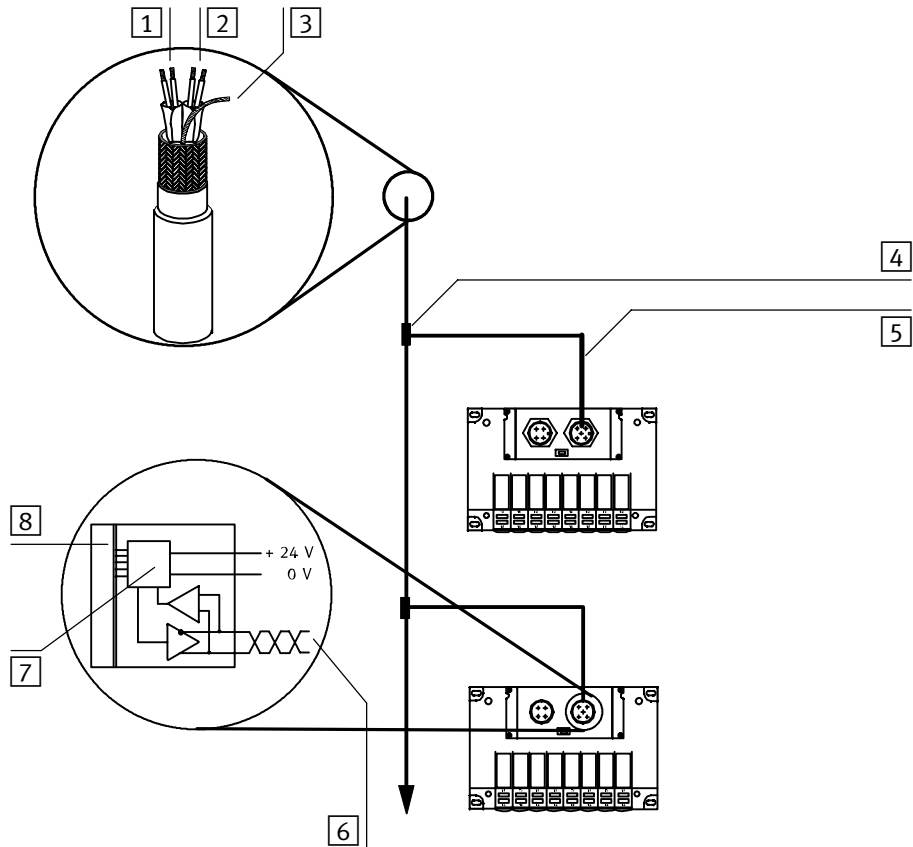


#### **Please note**

Refer to the manual for your PLC or scanner, to ascertain which T-adapter and which maximum branch line length are permitted for your controller.

The summary below shows the structure of the bus interface and the connection via a branch line.

## 1. Installation



- |                |                  |
|----------------|------------------|
| 1 Field bus    | 5 Branch line    |
| 2 Power supply | 6 Bus            |
| 3 Screening    | 7 Microprocessor |
| 4 T-adaptor    | 8 Valve driver   |

Fig. 1/10: Structure and connection of the bus interface

## 1. Installation

Bus supply/logic supply

Avoid long distances between the bus interface supply/logic supply and the CPV valve terminal.



### Please note

Bus slaves of different manufacturers have different tolerances as regards the interface supply. Take this into consideration when planning the bus length and in locating the power unit.



### Recommendation:

Place the power unit approximately in the centre of the bus. The following tolerance in the bus interface supply applies to the Festo CPV valve terminals:

$$V_{\max} = 25.0 \text{ V}$$

$$V_{\max} = 11.5 \text{ V}$$

Pin assignment of the field bus interface

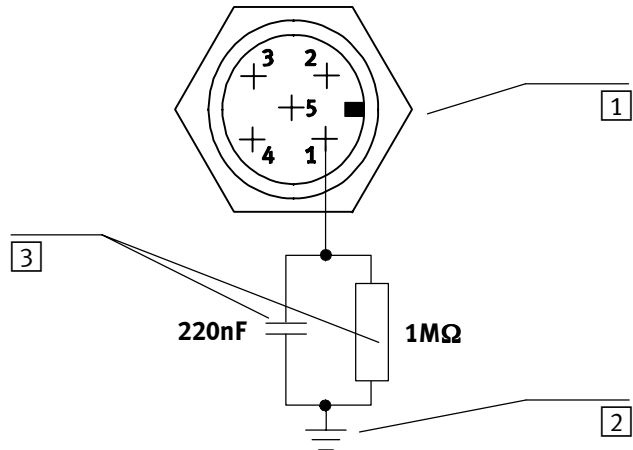
Connect the field bus cable correctly to the pins of the bus cable socket. When doing this, note also the following connection instructions, as well as the instructions in the manual for your controller or scanner.



### Caution

- Make sure of the correct polarity when connecting the field bus interface and the power supply for the bus interface/internal logic.
- Connect the screening.

## 1. Installation



- 1 Pin assignment
  - 1: Screening/shield (CAN\_SHLD)
  - 2: + 24 V DC bus interface/logic (CAN\_V+)
  - 3: 0 V bus interface/logic (CAN\_GND)
  - 4: Data+ (CAN\_H)
  - 5: Data- (CAN\_L)
- 2 Node housing PE
- 3 Internal screening connection in the CP valve terminal

Fig. 1/11: Internal RC resistance network and pin assignment of the field bus interface.

Connection instructions for DeviceNet



**Please note**

You must check the pin assignment of your scanner with the relevant documentation.

Connect the field bus cable of your control system to the field bus interface of the valve terminal as follows: The following diagram shows the connections for the SLC scanner and the SF60 valve terminals (integrated SLC scanner):

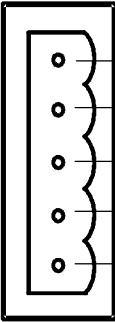
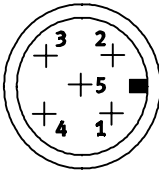
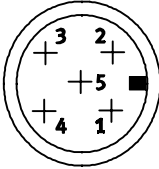
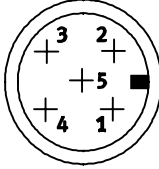
SLC scanner		CPV valve terminal with direct connection for DeviceNet	
<b>SLC scanner from Allen-Bradley</b>			
	RED	———— +24 V bus	Pin 2
	WHITE	———— Data+	4
	BARE	———— Screening	1
	BLUE	———— Data-	5
	BLACK	———— GND bus	3
			
<b>SF60 from Festo with integrated SLC scanner</b>			
	Pin 2	———— +24 V bus	Pin 2
	4	———— Data+	4
	1	———— Screening	1
	5	———— Data-	5
	3	———— GND bus	3
			

Fig. 1/12: Connection diagram for DeviceNet

## 1. Installation

### 1.4.1 Fit a terminating resistor

#### Terminating resistor

If the CPV valve terminal to be connected is at the end of the field bus, a terminating resistor (120 Ohm, 0.25 Watt) must be fitted.

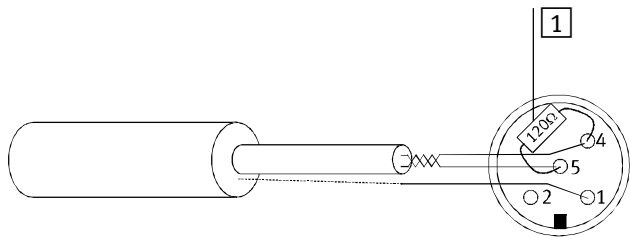
If you are using T-adapters, we recommend that you fit the terminating resistor on the unused output of the T-adapter.

If you do not use a T-adapter, you must fit the terminating resistor in the field bus socket. Crimp the wires of the resistor together with those of the field bus cable between the cores data+ (pin 4) and data- (pin 5) of the bus cable socket.



#### Please note

In order to guarantee reliable contact, we recommend that you crimp together the wires of the resistor and those of the incoming field bus cable in common end sleeves.



**1** Terminating resistor 120 Ohm, 0.25 W

Fig. 1/13: Fitting a terminating resistor

# Commissioning

## Chapter 2

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## 2. Commissioning

### 2.1 Preparing the CPV valve terminal for commissioning

**Please note**

Supply the valve terminal separately with load voltage.  
The field bus interface of the CPV valve terminal is supplied with voltage via the field bus cable.

#### 2.1.1 Compiling the configuration list

**Configuration list**

Before commissioning or programming, please compile a configuration list of all the connected field bus slaves. On the basis of this list you can:

- Carry out a comparison between the NOMINAL and the ACTUAL configurations in order to detect any connection faults.
- Access these specifications during the syntax check of a program in order to avoid addressing errors.

2. Commissioning

2.1.2 Address assignment of the CPV valve terminal

The CPV valve terminal with direct connection for DeviceNet always occupies 16 input addresses and 16 output addresses, irrespective of the number of valve coils fitted on it. The current status of the outputs (valves) is copied internally onto the input addresses. For further information on this see Appendix A.

The diagram below shows the addressing sequence of the individual CPV valve plates.

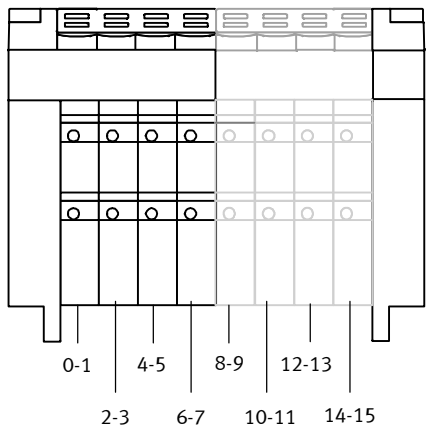


Fig. 2/1: Address assignment of a CPV valve terminal

## 2. Commissioning

- Addresses are assigned on the CPV valve terminal from left to right and on the individual valve locations from the front to the rear.

**12** Yellow LED row for pilot solenoid 12

**14** Yellow LED row for pilot solenoid 14

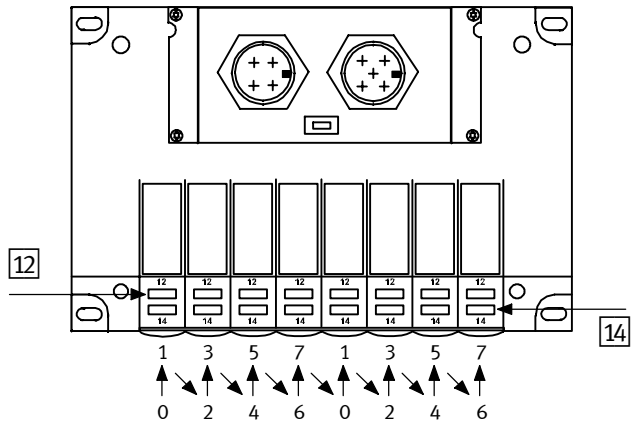


Fig. 2/2: Address assignment of CPV valve terminal

- A valve location on the CPV valve terminal always occupies 2 addresses, even if it is fitted with a reserve plate or pressure isolation plate. If a valve location is fitted with a double-solenoid valve, the following allocation applies:
  - pilot solenoid 14 occupies the lower-value address,
  - pilot solenoid 12 occupies the higher-value address. The higher-value address remains unused with single-solenoid valves.

## 2. Commissioning

### 2.1.3 Switching on the operating voltage

**Please note**

Please observe also the switching-on instructions in the manual for your PLC.

When the controller is switched on, it automatically carries out a comparison between the NOMINAL and ACTUAL configurations. For this configuration run it is important that:

- the specifications for configuration are complete and correct
- the power supplies for the PLC and the field bus slaves are switched on either simultaneously or in the sequence specified below.

Please note the following when switching on the power supply:

**Common supply**

If there is a common power supply for the control system and all the field bus slaves, the power should be switched on via a central power unit or switch.

**Separate supply**

If the control system and the field bus slaves have separate power supplies, the power should be switched on in the following sequence:

1. the power supply for all the field bus slaves,
2. the power supply for the controller.

### 2.2 Commissioning on the DeviceNet

**Please note**

- The Festo valve terminal type CPV...-GE-DN-8 can be used on all DeviceNet masters.
- This chapter describes the configuration and commissioning, using as an example the Allen-Bradley controllers.

#### 2.2.1 General information

Please note the following special features if the CPV valve terminal is used with the DeviceNet:

- The addresses of all known DeviceNet slaves can be assigned freely as M-file addresses or as discrete I/Os in the Scan list.
- The address assignment of a network slave is made in ascending order.
- The input and output addresses can be assigned independently of each other.

**Please note**

Assign the addresses of the network slaves so that there is sufficient reserve for later extensions.

The following sections contain general instructions on the configuration of a valve terminal on the DeviceNet.



Detailed information can be found in the documentation or in the helps for the configuration program used.

## 2. Commissioning

### 2.2.2 Configuring DeviceNet slaves (EDS)

If you are commissioning a DeviceNet slave for the first time, you must inform your configuration program of certain features of the slave. The features of the different slaves are usually managed by the configuration program in a list or library e.g. “EDS library” (EDS = electronic data sheets).

You can extend an “EDS library” in one of the following ways:

- by installing an EDS file
- by entering the slave features manually

#### Installing an EDS file

A CD ROM

A CD ROM for extending an EDS library is included with this manual. On this CD ROM you will find an EDS file and a picture file (Icon und Bitmap) for the valve terminal.

File type	File name
EDS file	DNDICP.EDS
ICO file (Icon)	DNDICP.ICO
BMP file (Bitmap)	DNDICP.BMP



Instructions on the directory structure of the CD ROM are contained in the file README.TXT in the main directroy of the CD ROM.

EDS file

The EDS file contains all the necessary features of valve terminal type CPV...-GE-DN-8. You can install this file with the aid of your configuration program.

ICO/BMP file

Depending on the configuration program used, you can assign the Bitmap file or Icon file to the valve terminal. The valve terminal will then be represented accordingly in the configuration program.

## 2. Commissioning



Instructions on installing an EDS file and an ICO or BMP file can be found in the manual or in the helps for your configuration program.

### Entering the slave features manually

When an EDS file is installed, the following information on the DeviceNet slave will be added to the EDS library. This information can also be entered manually.

Information	User manual
Vendor name	Festo Corporation
Device type	Valve terminal
Product code	8720
Major revision/Minor revision	2.0
Input size/Output size	2 bytes/2 bytes
Product name	CP valve terminal type 10
Catalog number	CPV-DNET-8

When the EDS library has been extended, the valve terminal is entered in the slave list as a possible DeviceNet slave. It can now be added to a network.

### 2.2.3 General instructions on parametrizing on the DeviceNet

When the slave features have been configured (e.g. by the installation of an EDS file), the following steps are required for parametrizing, depending on the configuration program.

**Please note**

The CPV valve terminal with direct connection type CPV...-GE-DN-8 only supports the transmission mode Polled connection.

1. Insert slave into project/network (online or offline). If the slave is inserted e.g. offline, it will be selected from the slave list and added to the network.
2. Assigning the slave to a scanner A network can contain several scanners. The slave must be assigned to a scanner.
3. Determine the I/O parameters of the slave. The following specifications are required here:
  - The number of I/O bytes to be transmitted. The following applies to valve terminal type CPV...-GE-DN-8:
    - 2 input bytes defined firmly
    - 2 output bytes defined firmly
  - Specifying the communication type The following applies to valve terminal type CPV...-GE-DN-8:  
Polled communication.  
Strobed or Change of State files are not supported.
  - Assign the I/O addresses of the slave to the PLC operands.
4. Load the configuration in the scanner.

## 2. Commissioning

### 2.2.4 Instructions on parametrizing with RSNetWorx for DeviceNet

This section gives instructions on parametrizing with RSNetWorx for DeviceNet version 2.11.51 from Rockwell.



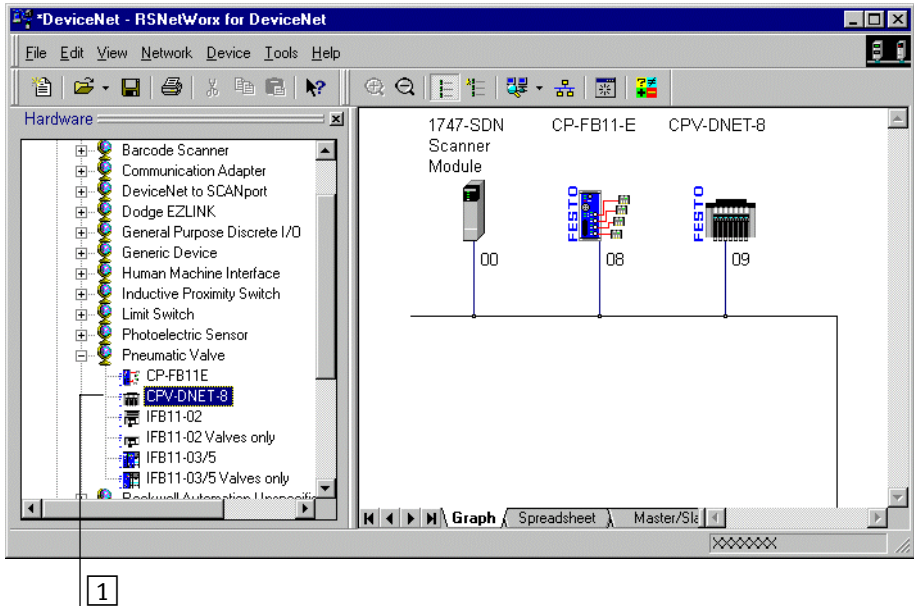
#### **Please note**

All the steps listed refer as an example to the Allen-Bradley scanner 1747-SDN. They apply accordingly to other masters.

#### **Insert slave in project/network**

RSNetWorx for DeviceNet contains an EDS assistant which supports you in installing the EDS file. When the EDS file has been installed, the valve terminal is included in the “Hardware” list. You can pull slaves over and insert them in the network on the right-hand side.

## 2. Commissioning



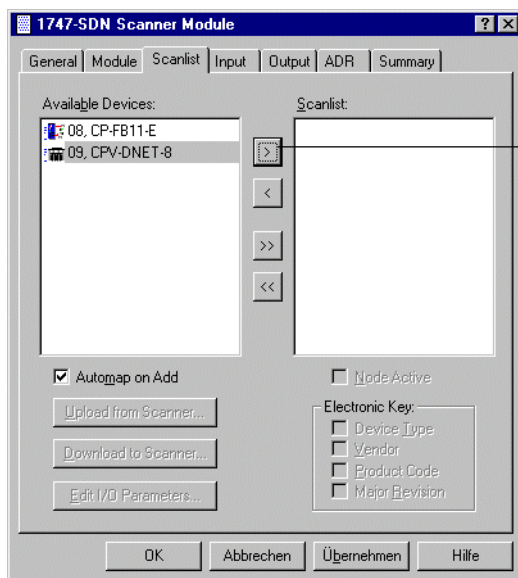
1 Valve terminal type CPV...-GE-DN-8 in the “Hardware” list

Fig. 2/3: Hardware list and network in RSNetWorx for DeviceNet

## 2. Commissioning

### Assigning the slave to a scanner

A double-click on the desired scanner in the network opens a dialogue field, with which you can assign the available slaves to the scanner.



1 Button for assigning the slave

Fig. 2/4: Register card "Scanlist" (example)

### Parametrizing slaves

A double-click on the slave opens a dialogue field, with which you can determine the I/O parameters of the slave.

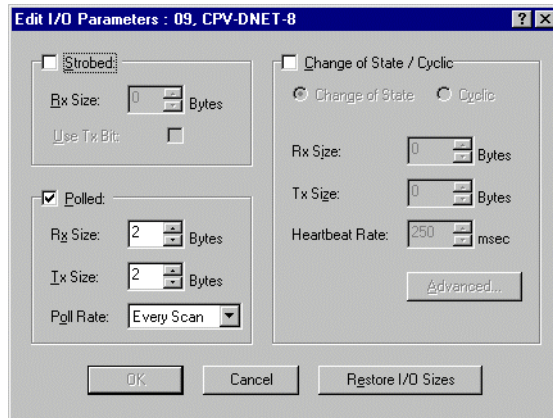


Fig. 2/5: Dialogue field “Edit I/O parameters”

The following applies to valve terminal type CPV...-GE-DN-8:

- Communication type: Polled Strobed or Change of State files are not supported.
- The number of I/O bytes to be transmitted is fixed at 2 input bytes and 2 output bytes.

## 2. Commissioning

### Assigning the I/O addresses of the slave

With the register cards “Output” and “Input” you can assign the I/O addresses of the valve terminal to the PLC operands.

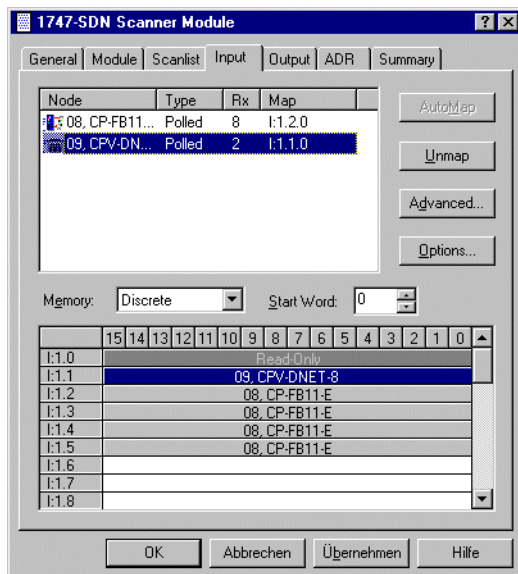


Fig. 2/6: Address assignment of the inputs (example)

## 2. Commissioning

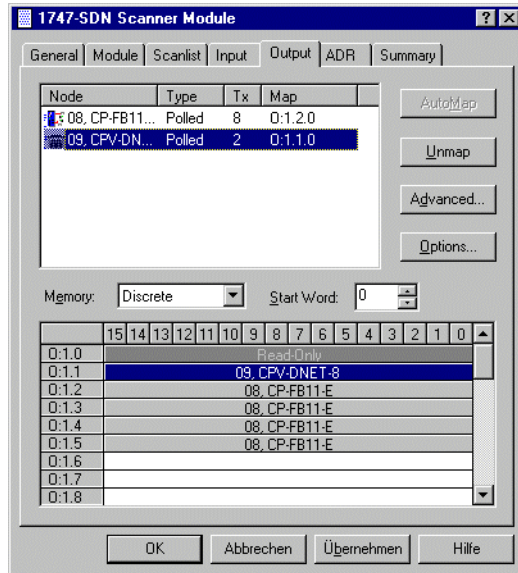


Fig. 2/7: Address assignment of the outputs (example)

2. Commissioning

Load the configuration in the scanner

Finally, load the configuration data in the scanner. Further information on this can be found in the documentation for your scanner.

2.2.5 Explicit messages

DeviceNet scanner 1771-SDN/B provides the “Explicit message program control feature”. With this function typical data of the valve terminal, e.g. such as is output with the function “Network Who”, are loaded into the user program where they are processed.

The reading and writing of these data takes place via BTR 62 or BTW 62. Details on the sequence of this function can be found in the manual for your scanner. The following data can be read out of the valve terminal:

Object class	Class ID	Instance	Attribute	Function	Value	
Identity	1	1	1	Vendor ID	26 <sub>D</sub>	1A <sub>H</sub>
			2	Product type	25 <sub>D</sub>	19 <sub>H</sub>
			3	Product code	8720 <sub>D</sub>	2210 <sub>H</sub>
			4	Revision	V2.0	
			5	Status	0	
			6	Series number	Field bus node specific	
			7	Name	CPV-DNET-8	

2. Commissioning

# Diagnosis

## Chapter 3

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### 3. Diagnosis

#### 3.1 Summary of diagnostic possibilities

The CPV valve terminal offers the following possibilities of diagnosis and error treatment:

- Diagnosis via the integrated LEDs
  - Valve terminal status
  - Valve status display
- Valve test
- Diagnosis via the field bus

Module/  
network status LED

The combination LED for the module/network status is a two-colour LED. This lights up or flashes green or red, or green and red together (orange), depending on the operating status of the valve terminal. It indicates the module status and the network status.

Signal status display

There is a yellow LED for each valve solenoid coil. This indicates whether the relevant valve solenoid coil is energized.

Valve test

An integrated test routine permits automatic cyclic switching of the valves.

Diagnosis via field bus

You can evaluate the Device Failure Table via the user program.

### 3. Diagnosis

#### 3.2 Diagnosis with LEDs

The LEDs on the cover of the CPV valve terminal indicate the operating status of the CPV valve terminal.

- 1** Module/network status LED (red/green)
- 12** Yellow LED row for pilot solenoid 12
- 14** Yellow LED row for pilot solenoid 14

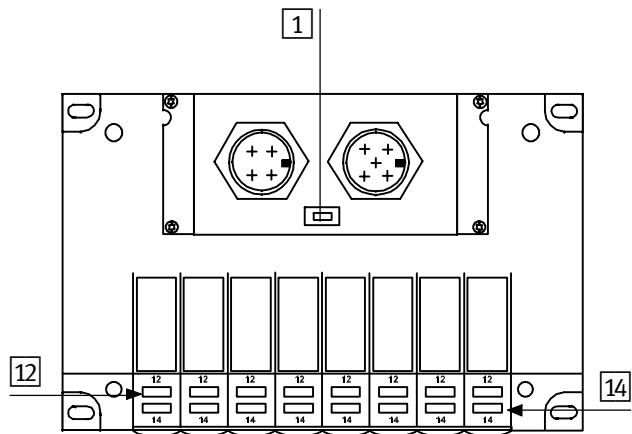


Fig. 3/1: LEDs of the CPV valve terminal with DeviceNet direct connection

#### LED test

When the communication part has been switched on, the following LED test is carried out:


- The module/network status LED lights up green for 250 ms
- The module/network status LED lights up red for 250 ms

3. Diagnosis

3.2.1 Normal operating status







In normal operating status the module/network status LED lights up green.

 lights up;  flashes;  out)

LED	Colour	Operating status	Error treatment
	Green	Normal; the CPV valve terminal is online and in contact with a communication partner	None

### 3. Diagnosis



#### 3.2.2 Error display of the module/network status LED

LED	Colour	Operating status	Error treatment
	None	<ul style="list-style-type: none"> <li>– The bus interface of the CPV valve terminal is not supplied with current</li> <li>– The CPV valve terminal does not recognize any communication on the bus</li> </ul>	<ul style="list-style-type: none"> <li>• Check the power supply of the bus interface/internal logic</li> <li>• Check the set baud rate</li> <li>• Check the physical connection to the bus and the terminating resistor.</li> </ul>
	Flashes green	The CPV valve terminal is ready for data exchange and is online on the bus. But there is no communication connection to a partner (master). It is possible that the CPV valve terminal is not yet assigned to a master.	<ul style="list-style-type: none"> <li>• Complete the configuration. Check/correct the scan list of the appropriate master.</li> </ul>
	Flashes red, fast	Non-permitted station number set.	<ul style="list-style-type: none"> <li>• Set a station number between 0...63.</li> </ul>
	Flashes red, slowly	Fault can be eliminated <ul style="list-style-type: none"> <li>– The CPV valve terminal has recognized Communication time-out.</li> <li>– The CPV valve terminal has not been addressed for a long period (time-out time).</li> </ul>	<ul style="list-style-type: none"> <li>• Physical bus connection interrupted. Check master for communication ability.</li> <li>• Reset time-out status of the CPV valve terminal by re-allocation. Switch on the CPV valve terminal to the bus again.</li> </ul>
	Lights up red	Serious communication fault <ul style="list-style-type: none"> <li>– The CPV valve terminal has discovered too many faulty telegrams on the bus and no longer takes part in bus communication. The CPV valve terminal is in the bus-off status.</li> </ul> or <ul style="list-style-type: none"> <li>– The node address of the CPV has been assigned twice</li> </ul>	<ul style="list-style-type: none"> <li>• Bad physical bus connection; check the connection.</li> <li>• Bus has serious fault; eliminate faults, check screening.</li> <li>• The power supply to the bus has been interrupted.</li> <li>• Correct the incorrect polarity of the data cables at one of the slaves</li> <li>• Check/correct baud rate</li> <li>• Correct the node address</li> </ul>
	Lights up orange	Load voltage for valves too low	<ul style="list-style-type: none"> <li>• Eliminate undervoltage at the load voltage connection</li> </ul>

3. Diagnosis

3.2.3 LED for the status display of the valve solenoid coils

There is a yellow LED for each valve solenoid coil (see Fig. 3/1). This LED indicates the switching status of the valve solenoid coil.

LED	Colour	Switch position Valve solenoid coil	Error treatment
	None	Basic position	Logical 0 (no signal)
	Yellow lights up	<ul style="list-style-type: none"><li>– Switch position</li><li>or</li><li>– Basic position</li></ul>	Logical 1 (signal present)  Logical 1 but: <ul style="list-style-type: none"><li>– Load voltage of the valves lies below the permitted tolerance range (&lt; 20.4 V DC)</li><li>or</li><li>– Compressed air supply not correct</li><li>or</li><li>– Pilot exhaust blocked</li><li>or</li><li>– Servicing required</li></ul>



**Please note**  
If there is no valve coil, the assigned LED will not indicate control of the output.

3.3 Testing the valves



**Warning**  
Before starting the test:  
switch off the compressed air supply to the CPV valve terminal.

You can thereby avoid unexpected or dangerous movements of the actuators.



- Caution**
- This test function runs automatically in the CPV valve terminal. All valves will be switched on/off cyclically.
  - None of the programmed interlockings or further switching conditions will be taken into account.

The CPV valve terminal provides the following test routines:

Test routine	Meaning
Parallel	All the valves of a byte will be switched on/off at the same time at 1-second intervals. Switching takes place continuously from byte 0 to byte 1 and vice versa.
Serial	All the valves of a byte will be switched on/off one after the other at 1-second intervals.
Switch on all the valves	All the valves are switched on

### 3. Diagnosis

#### 3.3.1 Starting the test routine

1. Switch off the power supply to the bus interface and the internal logic.
2. Remove the cover (see also chapter 2, Configuration).
3. Note the settings of the address selector switch and the DIL switch elements.
4. Set address 99 and DIL switch elements 1..2 to OFF.
5. Switch on the power supply to the bus interface and the internal logic, as well as to the CPV valves.
6. Set the desired test routine on the address selector switches as follows:

Test routine	Address to be set
Parallel	0
Serial	1
Switch on all the valves	2

7. Start: Set DIL switch elements 1 and 2 to ON.

If faults occur when the test routine is started, the red LED on the node will flash fast. The procedure must then be repeated.

#### 3.3.2 Stopping the test routine

1. Switch off the power supply to the bus interface and the internal logic.
2. Set the address selector switch and the DIL switch elements to their original positions.

3.4 Reaction to faults in the control system

PLC/ protocol	Reaction		
	to a PLC stop	to field bus faults	to field bus interruptions
DeviceNet	Valves are reset	Valves are reset when time out has expired	Valves are reset immediately



**Please note**  
If the outputs are reset after a PLC stop, field bus interruption or fault, please observe the following:

- Single-solenoid valves move to the basic position
- Double-solenoid valves remain in the current position
- Mid-position valves move to the mid-position (depending on valve type: pressurized, exhausted or blocked)

## 3.5 Diagnosis on the DeviceNet

The following bus diagnoses are available:

- Diagnosis via the DeviceNet scanner
- Diagnosis via the user program

### Diagnosis via the DeviceNet scanner

The CPV valve terminal with direct connection for DeviceNet reacts on the DeviceNet in respect of the diagnosis like equivalent DeviceNet slaves. Special error messages are not output.

### Diagnosis via the user program

You can evaluate the Device Failure Table via the user program. The Device Failure Table is divided into several sections. The section Communications Failure Bitmap is interesting in conjunction with the valve terminal. In this section an error bit is set for each DeviceNet slave, if communication between the scanner and the slave is interrupted or faulty.

With the valve terminal, the error bit is set if:

- The bus connection is interrupted (e.g. plug disconnected) or
- If the bus interface is not supplied with power.

### 3. Diagnosis

# Technical appendix

## Appendix A

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## A.1 Technical specifications of the CPV valve terminal type CPV.-GE-DN-8

General	
<b>Temperature range:</b> – Operation – Storage/transport	- 5 °C ... + 50 °C
<b>Relative humidity</b>	95 % non condensing
<b>Protection class</b> as per EN 60529 Plug connector inserted or fitted with protective cap	IP65
<b>Protection against electric shock</b> Protection against electric shock (protection against direct and indirect contact as per EN 60204-1/IEC 204)	By PELV power unit (Protected Extra-Low Voltage)
<b>Protection against explosion</b> (As per EU guideline 94/9/EG, EN 50021 and EN 50281-1-1), do not disconnect when under tension.	II 3 G/D EEx nA II T5 -5 °C ≤ Ta ≤ +50 °C T 80 °C (year of manufacture see Ex-marking on the product)
<b>Valves</b>	See Pneumatics manual P.BE-CPV-...

Load voltage for solenoid coils of CPV valve terminal	
<b>Pin 2</b> Load voltage connection – Rated value – Tolerance	24 V DC 21.0...26.4 V
<b>Current consumption</b> – Pin 2	Sum of all switched-on CPV solenoid valves; see manual “CPV valve terminal”
<b>Residual ripple</b>	4 Vpp (within tolerance)
<b>Bridging time during logic voltage failure</b>	20 ms

<b>Power supply for bus interface/internal electronics</b>	
<b>Pins 2, 3; bus interface</b> – Rated value – Tolerance – Current consumption (at 24 V)	External fuse required 24 V DC (not protected against incorrect polarity) 11.5...25 V 50 mA
<b>Residual ripple</b>	4 Vpp (within tolerance)
<b>Bridging time</b> during logic voltage failure	20 ms

<b>Electromagnetic compatibility</b>	
– Interference emission – Immunity to interference	Tested as per EN 55011 Limit value class A*) Tested as per EN 50082-2
*) The CPV valve terminal with direct connection for DeviceNet type CPV..-GE-DN-8 may also be used with individual authorization in residential areas (living, business and commercial areas, small firms).	



Technical specifications for the pneumatic components can be found in the “Pneumatics manual, P.BE-CPV-...”.

A.2 DeviceNet specifications of the CPV valve terminal

DeviceNet Release 1.3

The CPV valve terminal with direct connection type CPV...-GE-DN-8 is operated as a slave on the DeviceNet network. As a DeviceNet slave, the CPV valve terminal supports in the assigned master/slave connection:

- explicit messages
- polled I/O messages.

“Explicit Unconnected Message Manager” (UCMM) is not supported by the CPV valve terminal.

DeviceNet message types

As a slave device of group 2 the CPV valve terminal supports the following message types:

Can identifier	GROUP 2 message type
10xxxxxx111	Duplicate MACID check message
10xxxxxx110	Unconnected explicit request message
10xxxxxx101	Master I/O poll command message
10xxxxxx100	Master explicit request message
xxxxxx = Node address	

DeviceNet class services

As a slave device of group 2 the CPV valve terminal supports the following class services and instance services:

Service code	Service name
05 (0x05)	Reset
14 (0x0E)	Get attribute single
16 (0x10)	Set attribute single
75 (0x4B)	Allocate group 2 identifier set
76 (0x4C)	Release group 2 identifier set

DeviceNet object classes

Folgende DeviceNet object classes are supported:

Class code	Object type	# of instances
01 (0x01)	Identity	1
02 (0x02)	Router	1
03 (0x03)	DeviceNet	1
04 (0x04)	Assembly	2 (1 for OUTPUT, 1 for INPUT)
05 (0x05)	Connection	2 (explicit, polled I/O)

### A.2.1 Identity object: Class code 01 (0x01)

The Identity object provides information for identifying the device as well as general information on the device.

#### Identity object class attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max object instance	UINT	1
6	Get	Max ID of class attribute	UINT	7
7	Get	Max ID of instance attribute	UINT	7

#### Identity object, instance 1 attributes

Attribute	Access	Name	Type	Value
1	Get	Vendor	UINT	0x1A
2	Get	Product type	UINT	0x19 /valve terminal
3	Get	Product code	UINT	0x2210 (type 10)
4	Get	Revision	STRUCT OF	
		Major revision	UINT	2
		Minor revision	UINT	0
5	Get	Device status	UINT	(see under <a href="#">1</a> )
6	Get	Serial number	UINT	(see under <a href="#">2</a> )
7	Get	Product name	STRUCT OF	
		Length	UINT	10
		Name	STRING [6]	CPV-DNET-8

Common services

Service code	Class	Instance	Service name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single

1 Slave status

bit 0	owned	0=not owned 1=owned (allocated)
bit 1	reserved	0
bit 2	configured	0
bit 3	reserved	0
bit 4-7	vendor specific	0
bit 8	minor cfg.fault	0=no fault 1=minor fault
bit 9	minor dev.fault	0=no fault 1=valve power is missing
bit 10	minor cfg.fault	0=no fault 1=major cfg. fault
bit 11	minor dev. fault	0=no fault 1=major device fault
bit 12-15	reserved	0



**Please note**  
Only bits 0 and 9 are used.

2 Unique serial number

A.2.2 Router object: Class code: 02 (0x02)

The Message router object represents a message connection, by means of which a service to any object class in the physical device or instance can be addressed.

Router object class attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
6	Get	Max ID of class attribute	UINT	7
7	Get	Max ID of instance attribute	UINT	2

Router object, instance 1 attributes

Attribute	Access	Name	Type	Value
2	Get	Number of connections	UINT	2

Common services

Service code	Class	Instance	Service name
14 (0x0E)	Yes	Yes	Get_Attribute_Single

A.2.3 DeviceNet object: Class code: 03 (0x03)

DeviceNet object class attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2

Router object, instance 1 attributes

Attribute	Access	Name	Type	Value
1	Get	MACID	UINT	Rotary switch
2	Get	Baud rate	UINT	DIP switch: 0=125, 1=250, 2=500
3	Get/Set	Bus off interrupt	BOOL	(see under <a href="#">3</a> )
4	Get/Set	Bus off counter	UINT	0x00 (see under <a href="#">4</a> )
5	Get/Set	Allocation information	STRUCT OF	Allocate service (see under <a href="#">5</a> )
		Choice byte	BYTE	
		Master node address	UINT	

Common services

Service code	Class	Instance	Service name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single
75 (0x4B)	No	Yes	Allocate master/slave
76 (0x4C)	No	Yes	Release master/slave

3 Bus off interrupt (BOI) is triggered when the Bus off state occurs. The following values are supported:

Bus off interrupt (BOI)	Action
0	Hold chip in OFF state (default)
1	If possible reset CAN chip

4 When the Bus off counter is set, it will be forced to 0, irrespective of the data value supplied.

5 Allocation\_byte

7	6	5	4	3	2	1	0
Reserve	Ack. Suppress	Cyclic	Change of state	Reserve	Bit strobe	Polled	Explicit messages

A.2.4 Assembly object: Class code: 04 (0x04)

Two instances of the Assembly object are supported. Instance 1 is for input data and instance 2 is for output data. The only Assembly instance attribute supported is the Value attribute (#3). The Get service is supported for the Assembly instances. The Set service is supported for the Output assembly.

Assembly object class attributes

Class service is not supported.

Assembly object, instance 1 attribute 3

The table below shows the I/O assembly data attribute format for the input data.

As the CPV valve terminal with direct connection type CPV..-GE-DN-8 does not have any inputs, the input data are a copy of the output data, but one (bus) cycle later. If the valve voltage is not applied, all input data will be set to 0.

In-stance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	Valve status 7	Valve status 6	Valve status 5	Valve status 4	Valve status 3	Valve status 2	Valve status 1	Valve status 0
	1	Valve status 15	Valve status 14	Valve status 13	Valve status 12	Valve status 11	Valve status 10	Valve status 9	Valve status 8

Instance 2 attribute 3

The table below shows the I/O assembly data attribute format for the output data which contain several pneumatic outputs.

In-stance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	Pneum. O 7	Pneum. O 6	Pneum. O 5	Pneum. O 4	Pneum. O 3	Pneum. O 2	Pneum. O 1	Pneum. O 0
	1	Pneum. O 15	Pneum. O 14	Pneum. O 13	Pneum. O 12	Pneum. O 11	Pneum. O 10	Pneum. O 9	Pneum. O 8
0 = Output									

### Common services

Service code	Class	Instance	Service name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	Yes	Yes	Set_Attribute_Single

#### A.2.5 Connection object: Class code: 05 (0x05)

The Connection objects manage the features of each communication connection. As slave of group II the CP valve terminal supports an explicit message connection as well as a POLL message connection.

There are two instances of the Connection object in the device. Instance #1 is assigned to the Explicit message connection. Instance #2 is assigned to the Poll I/O connection.

#### Connection object class attribute

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1

Connection object, instance 1 attribute  
(explicit message)

Attribute	Access	Name	Type	Value
1	Get	State	UINT	(see under <a href="#">1</a> )
2	Get	Instance type	UINT	0 = Explicit message
3	Get	Transport class trigger	UINT	0x83
4	Get	Production connection ID	UINT	(see under <a href="#">2</a> )
5	Get	Consumed connection ID	UINT	(see under <a href="#">2</a> )
6	Get	Initial comm. Char.	UINT	0x21
7	Get	Production size	UINT	18
8	Get	Consumed size	UINT	18
9	Get/Set	Expected packet rate	UINT	Application dependent
12	Get/Set	Timeout action	UINT	(see under <a href="#">3</a> )
13	Get	Prod. Path length	UINT	0
14	Get	Production path		(zero) (see under <a href="#">4</a> )
15	Get	Cons. Path length	UINT	0
16	Get	Consumed path		(zero) (see under <a href="#">4</a> )

### Connection object, instance 2 attributes (POLL connection)

Attribute	Access	Name	Type	Value
1	Get	State	UINT	(see under <a href="#">[1]</a> )
2	Get	Instance type	UINT	1 = I/O message
3	Get	Transport class trigger	UINT	0x82
4	Get	Production connection ID	UINT	(see under <a href="#">[2]</a> )
5	Get	Consumed connection ID	UINT	(see under <a href="#">[2]</a> )
6	Get	Initial comm. Char.	UINT	0x1
7	Get	Production size	UINT	2
8	Get	Consumed size	UINT	2
9	Get/Set	Expected packet rate	UINT	
12	Get/Set	Timeout action	UINT	(see under <a href="#">[3]</a> )
13	Get	Prod. Path length	UINT	6
14	Get	Production path	STRUCT OF	
		Log. seg., class	UINT	0x20
		Class number	UINT	0x04 (assembly)
		Log.seg., instance	UINT	0x24
		Instance number	UINT	0x01 (input)
		Log.seg., attribute	UINT	0x30
		Attribute number	UINT	0x03
15	Get	Cons. Path length	UINT	6
16	Get	Consumed path	STRUCT OF	
		Log. seg., class		0x20
		Class number		0x04 (assembly)
		Log.seg., instance	UINT	0x24

Attribute	Access	Name	Type	Value
		Instance number	UINT	0x02 (output)
		Log.seg., attribute	UINT	0x30
		Attribute number	UINT	0x03
17	Get	Production inhibit	UINT	0

Common services

Service code	Class	Instance	Service name
05 (0x05)	Yes	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

- 1 Connection states:  
0 = non-existent  
1 = configuring  
3 = established  
4 = timed out
- 2 Connection IDs:  
Connection 1 produced connection ID: 10xxxxxx011  
Connection 1 consumed connection ID: 10xxxxxx100  
Connection 2 produced connection ID: 01111xxxxxx  
Connection 2 consumed connection ID: 10xxxxxx101  
xxxxxx = Node address
- 3 Watchdog time-out activity:  
0 = Timeout (explicit messaging default)  
1 = Auto delete  
2 = Auto reset
- 4 If no data is available during the poll response a 0 length (zero) packet is returned.

A.3 Accessories



This chapter provides a summary of necessary and useful accessories.



**Please note**  
The following summaries do not claim to be complete. The addresses of the firms mentioned can be found at the end of this section.

CPV valve supply connection

The power supply for the CP valves is provided via a 4-pin M12 socket with PG7 or 9 screw connector. You can order these from Festo.

Design	Type	Part no.
PG7 straight	FBSD-GD7	18497
PG9 straight	FBSD-GD9	18495
PG7 angled	FBSD-WD7	18524
PG9 angled	FBSD-WD9	18525

Bus connection

The bus is connected via a branch line with a 5-pin M12 socket with a PG9 screw connector. You can order these from Festo.

Design	Type	Part no.
PG9 straight	BSD-GD9-5POL	18324

Alternately you can use ready-to-use cables from the following manufacturers:

Manufacturer	Addresses
Woodhead Industries Inc.	United States Daniel Woodhead Company 3411 Woodhead Drive Northbrook, Illinois 60062
	Canada Woodhead Canada Ltd. 1090 Brevik Place Mississauga, Ontario Canada L4W 3Y5
	United Kingdom Aero-Motive (U.K.) Ltd. 9, Rassau Industrial Estate Ebbw Vale, Gwent, NP3 5SD
	Germany H. F. Vogel GmbH Tullastraße 9 D-75196 Remchingen
Lumberg	United States Lumberg Inc. 11351 Business Center Drive Richmond, VA 23236
	United Kingdom Aero-Motive (U.K.) Ltd. The Mount, Highclere Newbury, Berkshire, RG 20 9QZ
	Germany Lumberg GmbH & Co. Hälverstraße 94 D-58579 Schalksmühle

Manufacturer	Addresses
Turck	United States Turck Inc. 3000 Campus Drive Plymouth, MN 55441-2656
	United Kingdom MTE Turck Ltd. Stephenson Road Leigh-on-Sea, Essex SS9 5LS
	Germany Hans Turck Gmbh & Co. KG Witzlebenstraße 7 D-45472 Mülheim an der Ruhr
Philips	Netherlands PMA Nederland Gebouw TQIII-4 Postbus 80025 NL-5600 JZ Eindhoven
	Germany Philips Industrial Electronics Miramstraße 87 D-34123 Kassel
Selectron	Switzerland Selectron Lyss AG Industrielle Elektronik Bernstraße 70 CH-3250 Lyss
	Germany Selectron System GmbH Schupfer Straße 1 Postfach 31 02 62 D-90202 Nürnberg



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